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TWO METHODS FOR THE TRANSMISSION OF IP DATAGRAMS OVER IEEE 802.3 NETWORKS

Status of this Memo

This memo describes two methods of encapsulating Internet Protocol (IP) [1] datagrams on an IEEE 802.3 network [2]. This RFC suggests a proposed protocol for the ARPA-Internet community, and requests discussion and suggestions for improvements. Distribution of this memo is unlimited.

Introduction

The IEEE 802 project has defined a family of standards for Local Area Networks (LANs) that deals with the Physical and Data Link Layers as defined by the ISO Open System Interconnection Reference Model (ISO/OSI). Several Physical Layer standards (802.3, 802.4, and 802.5) [2, 3, 4] and one Data Link Layer Standard (802.2) [5] have been defined. The IEEE Physical Layer standards specify the ISO/OSI Physical Layer and the Media Access Control Sublayer of the ISO/OSI Data Link Layer. The 802.2 Data Link Layer standard specifies the Logical Link Control Sublayer of the ISO/OSI Data Link Layer.

The 802.3 standard is based on the Ethernet Version 2.0 standard [6]. The Ethernet Physical Layer and the 802.3 Physical Layer are compatible for all practical purposes however, the Ethernet Data Link Layer and the 802.3/802.2 Data Link Layer are incompatible.

There are many existing Ethernet network installations that transmit IP datagrams using the Ethernet compatible standard described in [7]. IEEE 802.3 Physical Layer compatible connections can be added to these networks using an an Ethernet Data Link Layer compatible method for transmitting IP datagrams without violating the 802.3 standard. Alternatively, an 802.2/802.3 Data Link Layer compatible method for transmitting IP datagrams can be used.

Ethernet Compatible Method

IEEE 802.3 networks must use 48-bit physical addresses and 10 megabit/second bandwidth in order to be Ethernet compatible.

The IEEE 802.3 packet header is identical to Ethernet packet header except for the meaning assigned to one of the fields in the header. In an Ethernet packet header this field is used as a protocol type field and in an 802.3 packet header the field is used as a length field. The maximum allowed length field value on a 10 megabit/second

802.3 network is 1500. The 802.3 standard states that packets with a length field greater than the maximum allowed length field may be ignored, discarded, or used in a private manner. Therefore, the length field can be used in a private manner as a protocol type field as long as the protocol types being used are greater than 1500. The protocol type for IP, ARP and trailer encapsulation are all greater than 1500. Using this technique, the method for transmitting IP datagrams on Ethernet networks described in [7] can be used to transmit IP datagrams on IEEE 802.3 networks in an Ethernet compatible manner.

IEEE 802.2/802.3 Compatible Method

Frame Format

IP datagrams are transmitted in standard 802.2/802.3 LLC Type 1 Unnumbered Information format with the DSAP and SSAP fields of the 802.2 header set to 96, the IEEE assigned global SAP value for IP [8]. The data field contains the IP header followed immediately by the IP data.

IEEE 802.3 packets have minimum size restrictions based on network bandwidth. When necessary, the data field should be padded (with octets of zero) to meet the 802.3 minimum frame size requirements. This padding is not part of the IP packet and is not included in the total length field of the IP header.

IEEE 802.3 packets have maximum size restrictions based on the network bandwidth. Implementations are encouraged to support full-length packets.

Gateway implementations MUST be prepared to accept full-length packets and fragment them when necessary.

Host implementations should be prepared to accept full-length packets, however hosts MUST NOT send datagrams longer than 576 octets unless they have explicit knowledge that the destination is prepared to accept them. A host may communicate its size preference in TCP based applications via the TCP Maximum Segment Size option [9].

Note: Datagrams on 802.3 networks may be longer than the general Internet default maximum packet size of 576 octets. Hosts connected to an 802.3 network should keep this in mind when sending datagrams to hosts not on the same 802.3 network. It may

be appropriate to send smaller datagrams to avoid unnecessary fragmentation at intermediate gateways. Please see [9] for further information on this point.

Address Mappings

The mapping of 32-bit Internet addresses to 16-bit or 48-bit 802.3 addresses can be done in several ways. A static table could be used, or a dynamic discovery procedure could be used.

Static Table

Each host could be provided with a table of all other hosts on the local network with both their 802.3 and Internet addresses.

Dynamic Discovery

Mappings between 32-bit Internet addresses and 802.3 addresses could be accomplished through a protocol similar to the Ethernet Address Resolution Protocol (ARP) [10]. Internet addresses are assigned arbitrarily on some Internet networks. Each host's implementation must know its own Internet address and respond to 802.3 Address Resolution packets appropriately. It should also use ARP to translate Internet addresses to 802.3 addresses when needed.

Broadcast Address

The broadcast Internet address (the address on that network with a host part of all binary ones) should be mapped to the broadcast 802.3 address (of all binary ones).

The use of the ARP dynamic discovery procedure is strongly recommended.

Trailer Formats

Some versions of Unix 4.2bsd use a different encapsulation method in order to get better network performance with the VAX virtual memory architecture. Consenting systems on the same 802.3 network may use this format between themselves. Details of the trailer encapsulation method may be found in [11].

Byte Order

As described in Appendix B of the Internet Protocol specification [1], the IP datagram is transmitted over 802.2/802.3 networks as a series of 8-bit bytes.

Conclusion

The two encapsulation methods presented can be mixed on the same local area network; however, this would partition the network into two incompatible subnetworks. One host on a network could support both methods and act as a gateway between the two subnetworks; however, this would introduce a significant performance penalty and should be avoided.

The IEEE 802.2/802.3 compatible encapsulation method is preferable to the Ethernet compatible method because the IEEE 802.2 and IEEE 802.3 standards have been accepted both nationally and internationally and because the same encapsulation method could be used on other IEEE 802 Physical Layer implementations. However, there are many existing installations that are using IP on Ethernet and a controlled transition from Ethernet to IEEE 802.2/802.3 is necessary.

To this end, all new implementations should allow for a static choice of encapsulation methods and all existing implementations should be modified to provide this static choice as well. During the transition, all hosts on the same network would use the Ethernet compatible method. After 802.2/802.3 support has been added to all existing implementations, the IEEE 802.2/802.3 method would be used and the transition would be complete.

References

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